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Effects of Pollutants

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Generic Lesson Plan Template

You should submit this form in addition to any computer generated files/documents/models to your group folder on Angel. Please create a .zip file and upload the group of files as a single archive.

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Grade level(s)/Subject taught: (9) Earth Science, (10) Living Environment (mixed) Envirothon Team Advisor
Objectives: The objective of this lesson is to have students work with a working model of a watershed system that discharges polluted waters into a water basin. Within the watershed various land use areas are affecting the overall quality of the water being emptied into the basin. Students will be given the opportunity to manipulate the management techniques of various land uses to optimize water quality at the mouth of the watershed. Students will be able to hypothesize the effects that new techniques will have on specific pollutants. Students will become aware of the role that all land users have in keeping water quality high. This particular lesson is best suited for the Envirothon Team and the Living Environment Classes.

Please provide a rich **one-page, single-spaced**, description or a *vision* of your best thinking on a way or ways you might teach the planned lesson. (approximately ½ page for the teacher role, ½ page for the student role). Also, construct a tentative rubric that you might use with your students (see example)

Items to include in your lesson plan: (Choose your discipline/concepts from your own area).

1. *Write* the Mathematical Concept or "key idea" that modeling will be used to teach: (e.g. Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships)

and/or…

1b. *Write* the Science Concept or "key idea" that modeling will be used to teach: (e.g. Organisms maintain a dynamic equilibrium that sustains life).

Interdependence is the "key idea" that will be taught in this activity. Students need to appreciate that the human actions are relatively self serving, but that the impact of human actions on the ecosystem is often enough to tip the balance of nature off. Using this model, students can begin to understand how "normal" activities such as farming can affect the overall water quality. In addition, students can learn strategies to minimize human impact on the environment.

Materials: Projector, smart board, computer lab, jigsaw charts and directions sheet.

Using CSERD I have located a water quality simulator model created using STELLA by a group of people from Maryland including, Mary Ellen Verona, David H. Curtis, Roger Azevedo, and Susan Ragan (Project Director MVHS) among many others…

The website that houses the model is http://destiny.mbhs.edu/riverweb/contact.html
http://destiny.mbhs.edu/riverweb/

DAY 1

1. Initially, I would begin the activity by defining watersheds, tributaries, water discharge, and mouth of a river. Immediately after that I would break the class into random groups to create a list of major contributors of water pollution. After about 7-8 minutes we would regroup and create a list on the overhead while discussing some additional contributors that students may not have been able to come up with on their own.
2. In addition to the discussion on pollution contributors, I inform students about point source pollution and non-point source pollution.
3. As all students will need to be at a computer while working on this exercise, this class will need to be in the computer lab for access to the computers. All students will be asked to go to the students' corner page in the simulation. As a group we will discuss the pristine forest land use information. Students should realize that this causes minimal effect on the water quality. This should take about 10 minutes and the discussion should include what some of the good factors are within the pristine forest that prevents addition of pollutants. Students will be guided through the part one of the Jigsaw #1.
4. Students will be divided into land use groups. The goal of each group is to learn about the land use they have been assigned as well as the pollutants their land use adds to the water. Soon they will need to investigate best management techniques and using the model, manipulate different variables to hopefully increase the overall water quality in the watershed. But for right now, students will be given about 15 minutes to learn about their land use area compared to the pristine forest region we just discussed. Students will use the support materials linked to the model to complete part II of the 1st Jigsaw chart. Any information that is not obtained during class time will need to be completed for homework.

- I expect the kids to come to class on day 2 with all of the information for their land use complete and ready for the next step in the exercise. Students should be aware of each of the pollutant factors that their area contributes to the watershed although they may not have a strong understanding of what those factors do to harm the environment and waterway.

DAY 2

1. Each group will now break apart into what is known as an "Expert Group." In these groups students will need to learn about 2 specific concerns affecting water quality. I anticipate approximately 15 minutes for this portion of the exercise. Students will be broken into the following groups…

- Nitrogen & Phosphorus
- Heavy Metals & Toxins
- Water temperature & Dissolved Oxygen concentration
- Runoff & Sediments

2. Upon completion of the "Expert Group" activity, students will return the their Land Use groups to share what they have each learned about the water concerns. (25 minutes should be allotted for this sharing).

- This should take us to the end of the second class period and not homework is anticipated for this evening. All students will be encouraged to visit "Students' Corner" on the website to link to related sites that may increase knowledge and/or interest.

DAY 3

1. With a basic working knowledge of the water quality indicators, each student will be using a computer to manipulate the variables in the model to produce different changes. Essential, play around with the variables. If you were to implement new strategies in your land use, how would you expect it to influence

the water quality at the mouth of the river. Then use the model to investigate on your own. Allow students 15 – 20 minutes to perform this investigatory activity independently before bringing the students back together to determine what they were able to learn.

2. Students return to their land use groups for a discussion about what they felt was most effective for each of them in increasing the water quality. Hopefully the individual students were all able to come up with similar ideas. Share with students the "Best Management" resources on the website and see if their ideas are similar to what the students were able to deduce. (5-7 minutes)
3. In the next 15 minutes I want students to make a list of adjustments they would like to make in their land use area to positively impact water quality. Students will predict what kind of impact +/-/= (positive/negative/no impact) they believe the changes will have on the water quality.

DAY 4

1. Using Jigsaw #3 directions students will follow through the worksheet as directed, filling in the final data table and creating a concept map explaining how they have impacted water quality. Students will be given 1-2 full class periods to complete their final charts.

FINAL DAY

Students will present as a group back to the class about their land use region as well as the different indicators and who they can be successfully reduced, in turn affecting the water quality of the watershed. Students will be grades on their presentations according to accuracy (60%), presentation clarity (15%), visual display logic (15%), overall quality of delivery (10%).

The timeline is tentative as I am unsure of how long it would actually take to complete the activities described. Additional time would be allotted to ensure thorough understanding occurs for all students.